REMARKS

Claims 12-31 were pending prior to filing this Response. Claims 20, 23, 26 and 29 are being amended herein; claims 16 and 17 are being canceled; claims 32 and 33 are being added. Therefore, claims 12-15 and 18-33 remain for consideration.

Claims 16, 17, 20, 23, 26 and 31 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Applicants gratefully acknowledge the Examiner's determination of pending claims 16, 17, 20, 23, 26 and 31 containing allowable subject matter.

Claim 29 is objected to because of a typographical error with respect to the proper spelling of the word "magnetization". Claim 29 is being amended herein to correct the informality. It is therefore respectfully submitted that the objection to claim 29 is overcome.

Claims 11, 18, 21 and 29 are rejected on the ground of nonstatutory obviousness-type double patenting as allegedly being unpatentable over claims 1 and 3 of Schott et al. (U.S. Patent No. 7,038,448) in view of Tong et al. (U.S. Patent No. 5,199,178). The rejection is traversed and reconsideration is respectfully requested.

Claim 11 had been withdrawn and does not remain for consideration. It is assumed that the Examiner meant to base the rejection on claim 12, and therefore the rejection will be addressed with respect to claim 12.

Claim 12 recites *an excitation coil and an electronic circuit for the temporary application of a current to the excitation coil in order to restore the predetermined magnetization in the ferromagnetic core,* while claim 1 of Schott et al. recites *a current source for applying an AC current to the exciter coil, the exciter coil and the ferromagnetic core serving for chopping the first and second component of the magnetic field.* (Independent method claim 29 of the present application is similar to claim 1 with respect to applying current to an excitation coil for restoring the predetermined

magnetization of the ferromagnetic core). This means that the magnetic field sensor is operated like a fluxgate sensor wherein the ferromagnetic core is driven with a predetermined frequency into magnetic saturation and out of magnetic saturation, i.e. the magnetization of the cores changes its direction all the time. The operation of the magnetic field sensor as a fluxgate sensor is a completely different measurement principle with which the ferromagnetic core cannot be operated at a constant predetermined magnetization. Therefore the magnetic field sensor of Schott et al. does not contain an electronic circuit for the temporary application of a current to the excitation coil for restoring the predetermined magnetization in the ferromagnetic core. Besides, this would make no sense. Tong also does not disclose this limitation. Therefore claims 12 and 29 of the present application are not obvious over independent claim 1 and dependent claim 3 of Schott et al. in view of Tong.

Moreover, claims 18 and 21 each depend from and thereby incorporate the limitations of claim 12. Accordingly, claims 18 and 21 are not obvious over Schott et al. in view of Tong for at least the reasons set forth for claim 12.

Claims 12-15, 18, 19, 29 and 30 are rejected under 35 U.S.C. § 102(e) as allegedly being anticipated by Berkcan (U.S. Patent No. 6,750,644). The rejection is traversed and reconsideration is respectfully requested.

Berkcan discloses a magnetic field sensor intended for measuring the magnetic field produced by a current flowing through a wire 12. The magnetic field sensor comprises a C-shaped core 14. A C-shaped core differs from a ring-shaped core in that it always has an air gap (see figures 1, 2, 5 and 6 and claim 2). C-shaped cores are widely used in the field of current measuring and as the C-shaped core is substantially the basic structural element of the current sensor it is not possible to exchange the C-shaped core with a core having another shape, and more especially not to replace the C-shaped with a ring-shaped core which is a core that has no air gap. Therefore, Berkcan does not disclose a ring-shaped core and does not contain

any hint suggesting to replace the C-shaped core with a ring-shaped core as recited in claims 12 and 29 of the present application.

Berkcan does not show that its C-shaped core is attached to a semiconductor chip. Berkcan's core stands alone. The magnetic field sensor of Berkcan comprises a Hall element 18 that is made of a semiconductor material and is arranged in the air gap 16 of the C-shaped core (column 2, lines 32-35). The semiconductor chip with the Hall element lies in a plane that runs perpendicular to the plane of the C-shaped core. Furthermore, the semiconductor chip is encapsulated in a housing of plastic material, so there is no possibility to attach the C-shaped core directly to the semiconductor chip as recited in claim 12.

Berkcan does not show a read-out sensor comprising at least one sensor that is integrated into the semiconductor chip and arranged in the vicinity of an outer edge of the ferromagnetic core and that measures the at least one component of the magnetic field. Berkcan shows a sensor comprising a Hall element that is placed in the air gap 16 of the C-shaped core which is not in the vicinity of an outer edge of the ferromagnetic core.

The invention of Berkcan consists in that the magnetic field sensor is provided with a calibration coil so as to change the magnetic field present in the air gap of the core when energized, means for selectively energizing the calibration coil and means for determining the sensitivity of the magnetic field sensor based on the difference of the output signal when the calibration coil is energized and the output signal when the calibration coil is not energized. In contrast to this the present invention as recited in claim 12 teaches that the ferromagnetic core is magnetized with a predetermined magnetization and that an excitation coil and an electronic circuit for the temporary application of a current to the excitation coil are present in order to restore the predetermined magnetization in the ferromagnetic core. Berkcan does not address the problem associated with an unpredicted change of the magnetization of the ferromagnetic core. Berkcan provides its magnetic field sensor

with calibration means so that the sensitivity of the magnetic field sensor can be determined in the presence of and independently of all external and internal interference and conditions such as the ambient temperature, the temperature of the core and any effects of the high permeability material used for the core. The present invention as recited in claim 12 does not provide calibration means for determining the sensitivity of the magnetic field sensor, but provides means for restoring the predetermined magnetization of the core and thus eliminates the influence of varying conditions of the core that thus may change the properties of the core and therefore also the sensitivity of the magnetic field sensor.

Berkcan discloses that the calibration coil has to create a magnetic field substantially in the same direction as the magnetic field to be sensed (column 5, lines 23-26). In contrast to this the excitation coil of the present invention has to magnetize the core to a predetermined magnetization that is completely independent from the direction of the magnetic field to be measured.

Having shown that the magnetic field sensors of Berkcan and of the present invention as recited in claim 12 are structurally different the anticipation rejection of claim 12 under 35 U.S.C. § 102(e) should be withdrawn and claim 12 allowed.

With regard to claim 13 of the present invention, Berkcan is silent as to how the core is magnetized. Berkcan does not mention a circular magnetization and the magnetization cannot be depicted from the drawings or from the orientation of the coil with regard to the core. The direction of the magnetization of the core is an inherent property that is not visible from the outside.

Claims 13-15, 18 and 19 depend directly or indirectly from claim 12 and therefore incorporate the limitations of claim 12. Accordingly, these dependent claims are not anticipated by Berkcan for at least the same reasons set forth for claim 12.

As explained in detail above Berkcan discloses a magnetic field sensor provided with a calibration coil for changing the magnetic field present in the air

gap of the core when energized, means for selectively energizing the calibration coil and means for determining the sensitivity of the magnetic field sensor based on the difference of the output signal when the calibration coil is energized and the output signal when the calibration coil is not energized. The calibration coil is used to produce a predetermined magnetic flux in the air gap of the core; it is not used to produce a predetermined magnetization in the core. In contrast to this, amended independent claim 29 of the present application discloses a method for operating a magnetic field sensor with which the ferromagnetic core of the sensor is initially magnetized with a predetermined magnetization and with which the predetermined magnetization is from time to time restored to the predetermined magnetization by temporary application of a current to an excitation coil. Besides the structural differences between the magnetic field sensor of Berkcan and the magnetic field sensor of the present invention, the method steps of amended claim 29 are completely different and serve for a different purpose. For at least these reasons the anticipation rejection of claim 29 under 35 U.S.C. § 102(e) should be withdrawn and amended claim 29 allowed.

With regard to claim 30, Berkcan is silent as to the strength of the magnetic field to be produced during the calibration step. Berkcan does not mention a circular magnetization and the magnetization cannot be depicted from the drawings or from the orientation of the coil with regard to the core. The direction of the magnetization of the core is an inherent property that is not visible from the outside. Furthermore, Berkcan does not relate the strength of the magnetic field to the properties of the ferromagnetic core such as the coercive field strength.

In addition to these differences, claim 30 depends from and thereby incorporates the limitations of claim 29. Accordingly, dependent claim 30 is not anticipated by Berkcan for at least the reasons set forth above with respect to claim 29.

Claims 12-15, 18, 19, 21, 22 and 29 are rejected under 35 U.S.C. § 102(e) as

allegedly being anticipated by Extance et al. (U.S. Pat. No. 4,692,703). The rejection is traversed and reconsideration is respectfully requested.

Extance et al. discloses a magnetic field sensor that is operated as a fluxgate magnetometer. The fluxgate magnetometer as shown in figure 3 comprises two flat rectangular metallic glass cores 11 and 12. Fluxgate operation means that the metallic glass cores are driven with a given frequency into positive magnetic saturation and negative magnetic saturation, i.e. the magnetization of the cores changes its direction all the time. This is shown in figure 2b. A Hall effect chip 13 is disposed between the end portions of the two cores 11 and 12. Figure 4 shows another embodiment where the metallic glass cores are combined into a single core with a closed loop configuration in order to detect circular magnetic fields such as produced by a DC current passing down a wire extending through the loop. However, also with this configuration the Hall effect chip 13 is disposed between the end portions of the single core 11'. The fluxgate magnetometer of Extance et al. differs from the magnetic field sensor as recited in claim 12 at least as follows:

The fluxgate magnetometer of Extance et al. has either two rectangular cores 11 and 12 or a single core 11' formed into a loop with an air gap between the end portions and a Hall effect chip placed in the air gap. Extance et al. does not disclose a ring-shaped ferromagnetic core, i.e. a core without an air gap, that is attached to a semiconductor chip and a read-out sensor comprising at least one sensor that is integrated into the semiconductor chip and arranged in the vicinity of an outer edge of the ferromagnetic core as recited in claim 12.

Furthermore, the magnetic field sensor of Extance et al. is operated as a fluxgate sensor. This is a completely different measurement principle with which the ferromagnetic core cannot be operated at a constant predetermined magnetization. Consequently, Extance et al. does not disclose an excitation coil and an electronic circuit for the temporary application of a current in order to restore the predetermined magnetization in the ferromagnetic core. Extance et al., on the

contrary, discloses an electronic circuit for driving the coil in the fluxgate mode. The person skilled in the art would never say that the magnetization is restored to a predetermined value for a magnetic field sensor that is operated in the fluxgate mode. In the fluxgate mode the measurement occurs while an AC current flows through the coil for permanently changing the direction of the magnetization and driving the core each time into magnetic saturation. With the present invention, however, a current is applied to the excitation coil between the measurements.

Having shown that the magnetic field sensors of Extance et al. and of the present invention as recited in claim 12 are structurally different, the anticipation rejection of claim 12 under 35 U.S.C. § 102(e) should be withdrawn and claim 12 allowed.

With regard to claim 13 of the present invention, Extance et al. is silent as to how the core is magnetized. Extance does not mention a circular magnetization and the magnetization cannot be depicted from the drawings or from the orientation of the coil with regard to the core.

Claims 13-15, 18, 19, 21, and 22 each depend directly or indirectly from claim 12 and thereby incorporate the limitations of claim 12. Accordingly, these dependent claims are not anticipated by Extance et al. for at least the same reasons set forth for claim 12.

As explained in detail above, Extance et al. discloses a magnetic field sensor provided with an excitation coil for operating the magnetic field sensor as a fluxgate magnetometer. The calibration coil is used to magnetically saturate the core in alternating directions during the measurement. In contrast to this amended claim 29 discloses a method for operating a magnetic field sensor with which the ferromagnetic core of the sensor is initially magnetized with a predetermined magnetization and with which the predetermined magnetization is from time to time, between the measurements, restored to the predetermined magnetization by temporary application of a current to an excitation coil. Apart from the structural

differences between the magnetic field sensor of Extance et al. and the magnetic field sensor recited in amended claim 29, the method steps are completely different and serve for different purposes. The core of the magnetic field sensor of Extance et al. is permanently driven in and out of saturation, whereas with the present invention the magnetization of the core is restored to a predetermined value at specific times only. "At specific times" is certainly not the same as "permanently". For at least these reasons the anticipation rejection of claim 29 under 35 U.S.C. § 102(e) should be withdrawn and amended claim 29 allowed.

Claims 24, 25, 27 and 28 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Extance et al. (U.S. Pat. No. 4,692,703). The rejection is traversed and reconsideration is respectfully requested.

As was demonstrated above, Extance et al. does not teach each and every feature of claim 12 and accordingly contains insufficient teaching to anticipate claim 12 from which rejected claims 24, 25, 27 and 28 each ultimately depend. It therefore follows that Extance et al. also contains insufficient teaching as a primary reference to render obvious claims 24, 25, 27 and 28. Therefore claims 24, 25, 27 and 28 which depend directly or indirectly from claim 12 should be allowed for at least the same reasons set forth for claim 12.

In view of the foregoing, it is respectfully submitted that amended claims 12-15 and 18-33 are in condition for allowance. All issues raised by the Examiner having been addressed, an early action to that effect is earnestly solicited.

No fees or deficiencies in fees are believed to be owed. However, authorization is hereby given to charge our Deposit Account No. 13-0235 in the event any such fees are owed.

Respectfully submitted,

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